

**MAGNETIC SENSOR WITH UNDERLAYERS PROMOTING HIGH-  
COERCIVITY, IN-PLANE BIAS LAYERS**

**ABSTRACT**

A magnetic sensor is disclosed comprising an antiferromagnetic layer; a first ferromagnetic layer disposed over the antiferromagnetic layer, the first ferromagnetic layer having a magnetization that is pinned by the antiferromagnetic layer; a second ferromagnetic layer disposed over the first ferromagnetic layer, the second ferromagnetic layer having a magnetization that rotates due to an applied magnetic field; a third ferromagnetic layer disposed adjacent to an end of the second ferromagnetic layer, the third ferromagnetic layer having a primarily in-plane magnetization providing a magnetic field to stabilize the end of the second ferromagnetic layer; an amorphous, metallic, nonmagnetic underlayer disposed adjacent to the antiferromagnetic layer; and a crystalline seed layer disposed between the underlayer and the third ferromagnetic layer, the seed layer having a crystalline structure that promotes the in-plane magnetization of the third ferromagnetic layer.